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Featured Article

Population-based stroke and dementia incidence trends: Age and sex variations

Joshua O. Cerasuolo[a], Lauren E. Cipriano[a,b], Luciano A. Sposato[c], Moira K. Kapral[d,e], Jiming Fang[e], Sudeep S. Gill[f,g,h], Daniel G. Hackam[i], Vladimir Hachinski[c,*]

[a]Department of Epidemiology and Biostatistics, Schulich School of Medicine & Dentistry, Western University, London, Ontario, Canada
[b]Ivey Business School, Western University, London, Ontario, Canada
[c]Department of Clinical Neurological Sciences, London Health Sciences Centre, Western University, London, Ontario, Canada
[d]Department of Medicine, University of Toronto, Toronto, Ontario, Canada
[e]Institute for Clinical Evaluative Sciences, Toronto, Ontario, Canada
[f]Institute for Clinical Evaluative Sciences, Queen's University, Kingston, Ontario, Canada
[g]Division of Geriatric Medicine, Queen's University, Kingston, Ontario, Canada
[h]Division of Geriatric Medicine, St. Mary's of the Lake Hospital, Kingston, Ontario, Canada
[i]Division of Clinical Pharmacology, Department of Medicine, Western University, London, Ontario, Canada

Abstract

Introduction: We discovered a concomitant decline in stroke and dementia incidence rates at a whole population level in Ontario, Canada. This study explores these trends within demographic subgroups.

Methods: We analyzed administrative data sources using validated algorithms to calculate stroke and dementia incidence rates from 2002 to 2013.

Results: For more than 12 years, stroke incidence remained unchanged among those aged 20 to 49 years and decreased for those aged 50 to 64, 65 to 79, and 80+ years by 22.7%, 36.9%, and 37.9%, respectively. Dementia incidence increased by 17.3% and 23.5% in those aged 20 to 49 and 50 to 64 years, respectively, remained unchanged in those aged 65 to 79 years, and decreased by 15.4% in those aged 80+ years.

Discussion: The concomitant decline in stroke and dementia incidence rates may depict how successful stroke prevention has targeted shared risk factors of both conditions, especially at advanced ages where such risk factors are highly prevalent. We lend support for the development of an integrated system of stroke and dementia prevention.

Keywords: Age; Dementia; Incidence; Sex; Stroke; Temporal; Trend; Epidemiology

1. Introduction

Effective primary prevention efforts have decreased stroke incidence from 1990 to 2010, and improvements in early identification and treatment of stroke have decreased its mortality by 25% in the same 20-year span [1]. However, stroke remains a major health concern as the number of people living with a history of stroke increased by 27% in high-income countries between 1990 and 2010 [1]. Furthermore, stroke survivors have a twofold increased risk of dementia [2].

Results of two recent studies suggest that stroke prevention efforts may also prevent dementia. A population-based study in Ontario, Canada (with an ethnically diverse population of 13.8 million inhabitants [3]), showed a concomitant decline in stroke and dementia incidence rates for more than 12 years [4], coincident with a successful

*Corresponding author. Tel.: +1-519-663-3624; Fax: +1-519-663-3910.
E-mail address: Vladimir.Hachinski@lhsc.on.ca

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integrated stroke strategy [5,6]. Albeit from different studies, reports from the Framingham Heart Study similarly showed a decline in dementia incidence across four epochs spanning 30 years [7], concurrent with a decline in stroke incidence throughout a longer time frame [8]. Furthermore, the mean age at the time of diagnosis for both first stroke and dementia has increased over time [7,8]. The aforementioned studies were conducted separately but show a similar concomitant behavior of stroke and dementia incidence trends.

This study builds on previous work by exploring whether the previously observed concomitant declines in stroke and dementia incidence rates are present across demographic subgroups in Ontario, Canada, between 2002 and 2013.

2. Methods

We used the following administrative databases housed at the Institute for Clinical Evaluative Sciences for the accrual period of April 1, 1995 to March 31, 2014 (19 years): the Canadian Institute for Health Information Discharge Abstract Database (DAD) and National Ambulatory Care Reporting System (NACRS) to identify hospitalizations and emergency department visits, Ontario Health Insurance Plan (OHIP) to identify physician claims, Ontario Drug Benefit to identify prescription claims for residents aged 65 years and older, and the Same Day Surgery (SDS) database to identify procedures not requiring hospital admission. These data sources, which have been previously described [4], are validated and used extensively for health research and comprise almost 100% case ascertainment in Ontario, with the exception of the Ontario Drug Benefit that only includes individuals who are aged 65 years and older. We excluded subjects missing their age, sex, health number, or who are not residents of Ontario.

We identified stroke and dementia using validated algorithms, as previously described [4]. Stroke was classified using International Classification of Disease, Ninth Revision (ICD-9) codes (OHIP): 430, 431, 434, and 436, and ICD-10 (10th Revision) codes (DAD, NACRS, and SDS): H34.1, I60, I63 (excluding I63.6), and I64. A stroke was defined as a single entry in the DAD, SDS, or NACRS with a most responsible diagnosis of stroke or two OHIP claims within a 365-day period with any mentioned diagnosis of stroke. Dementia was identified using ICD-9 codes (OHIP): 290, 331, and 797, and ICD-10 codes (DAD, NACRS, and SDS): F000-F002, F009-F013, F018-F024, F028, F030, F051, F065, F066, F068-F090, G300, G301, and G308-G311. Dementia was defined as a single entry in the DAD, SDS, NACRS, or OHIP with any mention thereof in any diagnosis field, or at least one drug prescription dispensed for cholinesterase inhibitors. Only the first mention of stroke and dementia contributed to the incidence calculations.

Incidence was calculated for each fiscal year by dividing the number of newly identified cases against the total susceptible population in Ontario (i.e., individuals who were never diagnosed as a case) at the beginning of each fiscal year. Cases identified between April 1, 1995 and March 31, 2002 were excluded [9], to provide a 7-year washout period before incidence calculations based on the data availability at the Institute for Clinical Evaluative Sciences and consistent with the length of the washout period in our previously published report [4].

We calculated crude incidence rates stratified by sex and categorized by ages: 20 to 49, 50 to 54, 55 to 59, 60 to 64, 65 to 69, 70 to 74, 75 to 79, and 80+ years. We report age-standardized incidence rates (per 1000 susceptible Ontario population) for stroke and dementia in each fiscal year between 2002 and 2013, stratified by sex (12 years). Furthermore, we also report sex-standardized annual incidence rates for summary age categories of 20 to 49, 50 to 64, 65 to 79, and 80+ years. The mean age at diagnosis was also calculated for stroke and dementia cases in each fiscal year. Kendall tau-b correlation coefficient [10] was used to evaluate statistical significance for ordered trends of incidence and mean age of diagnosis across observation years using a threshold of $P = .05$.

3. Results

3.1. Age-standardized incidence rates of stroke and dementia—stratified by sex

From 2002 to 2013, the age-standardized stroke incidence rates among women were lower than that of men (Fig. 1). In both sexes, age-standardized incidence rates for stroke decreased between 2002 and 2013 (Table 1): 31.8% for men (3.62–2.47 per 1000 population, P value for trend $<.0001$) and 32.3% for women (2.94–1.99,

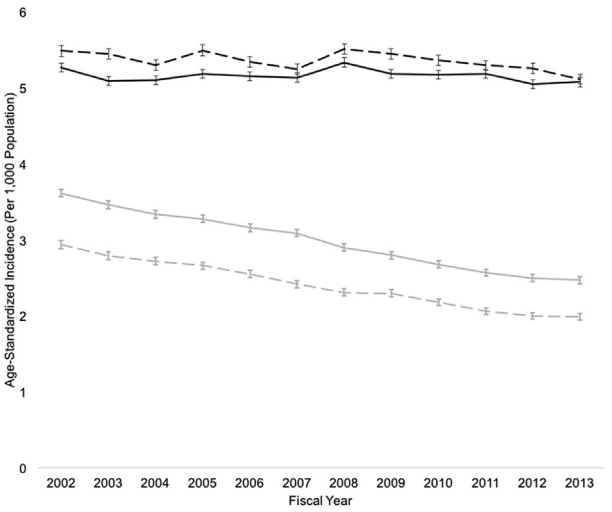

Fig. 1. Age-standardized incidence rates for stroke and dementia in Ontario, Canada (2002–2013), stratified by sex. Black lines represent dementia and gray lines represent stroke. Solid lines represent men and dashed lines represent women. Error bars symbolize 95% confidence intervals. Please refer to Table 1 for corresponding metrics.